Premiere Publications from The Triological Society

Read all three of our prestigious publications, each offering high-quality content to keep you informed with the latest developments in the field.

**THE LARYNGOSCOPE**

**FOUNDED IN 1896**

Editor-in-Chief: Michael G. Stewart, MD, MPH

The leading source for information in head and neck disorders.

Laryngoscope.com

**LARYNGOSCOPE INVESTIGATIVE OTOLARYNGOLOGY**

Editor-in-Chief: D. Bradley Welling, MD, PhD, FACS

Rapid dissemination of the science and practice of otolaryngology-head and neck surgery.

InvestigativeOto.com

**ENT today**

Editor-in-Chief: Alexander Chiu, MD

Must-have timely information that Otolaryngologist-head and neck surgeons can use in daily practice.

Enttoday.org
Developing a Synchronous Otolaryngology Telemedicine Clinic: Prospective Study to Assess Fidelity and Diagnostic Concordance

Nolan B. Seim, MD; Ramez H. W. Philips, BS; Laura A. Matrka, MD; Brittany Locklear, MS, RRT; Mark Inman, MBA; Aaron C. Moberly, MD; Garth F. Essig Jr., MD

**Objective:** To evaluate diagnostic concordance of a synchronous telemedicine otolaryngology clinic with use of currently available technology.

**Study Design:** Prospective.

**Methods:** Patients in a rural otolaryngology clinic were enrolled in a pilot telemedicine clinic. To assess system fidelity, an on-site and remote (consulting) otolaryngologist conducted simultaneous patient evaluations using streaming telecommunication technology for all aspects of the clinical encounter, including high-definition examination and endoscopic images. Both physicians and patients were blinded and diagnoses recorded. Post-encounter physician surveys and an original patient-centered TeleENT Satisfaction Questionnaire (TESQ) were used to assess overall satisfaction.

**Results:** Twenty-one patients were enrolled consecutively. Visual technology was found acceptable in all cases, and audio technology was acceptable in 20 of 21 encounters. Patient satisfaction was 96%, and patients felt comfortable using a telemedicine system in the future. Encounters were not significantly longer than traditional encounters. Physician diagnostic agreement was found in 95% of cases, and the consulting physician indicated that all encounters provided sufficient history, examination, and high-quality images to generate an accurate diagnosis, order additional workup, and/or make an appropriate referral.

**Conclusion:** A synchronous otolaryngology telemedicine clinic is comparable to a standard clinic in terms of diagnostic concordance and patient satisfaction when using streaming technology and high-definition images. Using telemedical technology may be a viable way to increase otolaryngology access in remote or underserved areas. With system validity now established, future studies will assess the feasibility of using on-site physician extenders (nurse practitioners or physician assistants) to conduct in-person patient encounters with remote otolaryngologist support.

**Key Words:** Telemedicine, real-time, synchronous, patient satisfaction, diagnostic concordance.

**Level of Evidence:** 2c.

**INTRODUCTION**

Telemedicine is the practice of using telecommunication technology to provide remote-access medical care, typically to an underserved region. It has been well established in many fields of medicine including radiology, cardiology, dermatology, and psychiatry, but its role for use in academic surgical subspecialties is yet to be fully explored. As technology improves, costs decrease, and more efficient protocols are established, the use of telemedicine will continue to expand in all areas of medicine. Otolaryngologists represent a relatively small subset of surgical specialists, mostly located in urban areas and largely underrepresented in the rural community setting. Additionally, a primary component of the patient evaluation in otolaryngology depends on images that can be digitized (e.g., high-resolution computed tomography, endoscopic imaging), which are well suited for remote viewing using current technology. This clearly creates an ideal opportunity for further investigation into telemedicine technology as a potential resource to otolaryngologists.

Currently, telemedicine is used to deliver healthcare over a physical distance and has a role in numerous encounter types. As expected, the associated technology has significantly evolved over the last two decades, with streaming high-definition image-sharing capabilities, higher connection speeds, and more readily available equipment that is affordable. Successful telemedicine programs in otolaryngology previously have been described in the clinical setting, with older technology and on a relatively limited basis compared to other fields. Many programs successfully have employed asynchronous or store-and-forward platforms, for which there is no real-time interaction with the patient by the telemedicine physician. In contrast, real-time evaluation has been used,
but mainly in a teleconference-like format that excludes the ability to perform any type of detailed physical exam. With recent technological advances, real-time, streamed images have improved quality, speed, and efficiency, creating an opportunity to expand applications for otolaryngologists.7,8

The synchronous telemedicine format has several benefits over store-and-forward approaches, including maintaining the physician–patient interaction and relationship with a face-to-face encounter, improved history taking, the ability to direct the examiner during physical examination, and an opportunity to counsel the patient immediately regarding diagnosis. Thus, a real-time interaction, combined with high-definition examination images, and an effective interface between on-site and remote locations provide all the critical components for an otolaryngologist’s evaluation and diagnosis.

Despite numerous technical differences, previously reported telemedicine systems have resulted in increased patient volume, decreased wait times, and improved patient experience, as well as an effective cost–benefit ratio.5,9 However, previously published applications of telemedicine to otolaryngology primarily have been limited to unique situations, such as the aftermath of Hurricane Katrina—or to situations that require remote access to care across great physical distances, such as in Alaska and Australia.10 A telemedicine application that has received less attention but arguably would impact a much larger volume of patients is the rural or underserved patient populations. These patients often are faced with limited access to otolaryngologic care or may routinely be required to travel long distances for an otolaryngology consultation. To address this need, we have developed a synchronous (real-time) general otolaryngology telemedicine clinic, with the long-term goal of expanding care to rural Ohio communities. In this study, we aim to evaluate the diagnostic concordance achievable using a pilot telemedicine otolaryngology clinic by comparing the ability of an on-site and remote otolaryngologist to diagnose and treat patients. This would serve as the first step to developing a telemedicine otolaryngology system in which a well-trained physician extender (nurse practitioner or physician assistant) would serve as the on-site clinician, and a remote otolaryngologist would serve as the consulting physician. Prior to implementing that setup, it was important to assess the fidelity of the telemedicine equipment and setup to provide sufficient information for an on-site and remote otolaryngologist to provide concordant diagnoses. Moreover, we investigated encounter satisfaction for both patients and providers during our experimental pilot telemedicine clinic.

MATERIALS AND METHODS

Telemedicine Protocol

After institutional review board approval, a synchronous telemedicine pilot clinic was created using an already established community otolaryngology clinic in a rural hospital setting (Fig. 1). Faculty otolaryngologists at The Ohio State University Wexner Medical Center historically have staffed this rural clinic and continued to do so during this pilot project. All telemedical equipment, including otoscopes and endoscopes, were Storz products (Karl Storz Endoscopy-America, Inc., El Segundo, California, U.S.A.), and software was leased through Quintree (Quintree Medical LLC, Detroit, Michigan, U.S.A.). The Quintree system (Quintree Medical LLC) adheres to Health Insurance Portability and Accountability Act recommendations with regard to security, best practices, and protected health information controls. Quintree (Quintree Medical LLC) provides data encryption at rest as well as encryption of all traffic. All access is user-authenticated and logged within an audit trail. The manufacturer recommends a minimum connection speed of 4.0 Mbit/second for high-quality video streaming, which was used for this pilot program in conjunction with an already present fiber optic connection.

For enrollment, consecutive patients scheduled in this rural otolaryngology clinic were contacted via phone and offered participation in this study without compensation. Informed consent was obtained from all patients participating in this study. Patients were randomized into the on-site or remote group. After logistical and equipment setup, both the on-site and remote physicians reviewed the patient’s past medical history, current symptoms, and pertinent physical examination findings. The on-site physician then performed an otolaryngologic examination and correlated findings with the physical examination findings. Both the on-site and remote physicians reviewed and listened to voice recordings of the patient’s previous consultations and past medical history.

Patient contacted and consented for pilot synchronous telemedicine clinic

Patient registered in clinical and Quintree telemedicine environment

Consulting physician called and answers via Quintree environment

Consulting physician records diagnosis and completes survey: Consulting physician has opportunity to ask patient follow-up or clarification questions

Referring physician records diagnosis and completes survey

Consulting physician records diagnosis and completes survey

Patient completes survey via provided ipod

Patient contacted and consented for pilot synchronous telemedicine clinic

Patient registered in clinical and Quintree telemedicine environment

Consulting physician called and answers via Quintree environment

Referring provider completes H&P while remote physician observes only indicating issues visualizing exam in realtime

Referring physician mutates visit from consulting physician while discussing assessment and plan with patient

Consulting physician records diagnosis and completes survey

Fig. 1. Synchronous telemedicine clinic workflow. Workflow for the synchronous telemedicine pilot clinic and research study, including roles of the referring physician, consulting physician, and patient. Quintree: Quintree Medical LLC, Detroit, Michigan, U.S.A. [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]
consent was obtained upon enrollment. Patients were seen over two clinic days. Both new patients and established patients with new complaints were included. Postoperative patients and routine follow-ups were not included to assess concordance of diagnosis by the physicians. Patients were roomed per usual protocol, and the Quintree (Quintree Medical LLC) telemedicine clinical environment was set up after patient registration. The remote consulting physician was then connected for the encounter.

First, the on-site physician evaluated the patient by performing a complete history and physical exam while the remote physician observed from a tertiary care medical center approximately 50 miles away. This simultaneous evaluation was done to avoid excessive repetition for the patient; both physicians were experienced otolaryngologists who were likely to obtain a similar history. The consulting physician visualized all aspects of the physical examination performed by the referring provider in real time. Peripheral Storz equipment (Karl Storz Endoscopy-America, Inc.) was connected via the Quintree interface (Quintree Medical LLC) and streamed to allow real-time visualization of high-definition images during otoscopy, rhinoscopy, oral cavity, and endoscopic exams (Fig. 2). The otoscope was used to obtain the otoscopic, nasal, and oral cavity exam. A flexible laryngoscope with distal-chip technology was used for visualization of the larynx when indicated. The remote physician was able to communicate any issues with the audio or visual assessment in real time, and minor adjustments were made as required.

After the exam was completed, the remote physician muted the encounter while the referring physician discussed the assessment and plan with the patient. This blinded the remote physician to the diagnosis made by the on-site physician. The on-site physician then recorded a diagnosis and completed the post-encounter survey. The remote physician was then able to ask any follow-up questions to the patient, helping to establish further rapport and clarify the diagnosis. The consulting physician then recorded a diagnosis and completed the post-encounter survey. This concluded the encounter, and the patients immediately completed their own post-encounter survey on an iPad (MP2G2LL/A model iPad 32 GB, Apple Inc., Cupertino, California, U.S.A.) prior to leaving the room.

**Data Analysis**

A patient-centered TeleENT Satisfaction Questionnaire (TESQ) survey was created from established institutional and
previously published telemedicine satisfaction surveys to serve as the post-encounter survey (Fig. 3). The TESQ was completed using the website SurveyMonkey (San Mateo, California, U.S.A.) via a local WiFi network. The results were anonymously downloaded, tabulated, and stored on a password-protected database. The physician diagnoses were likewise stored anonymously on a password-protected database and analyzed post-encounter. The on-site otolaryngologist was responsible for the clinical encounter and deemed the gold standard when comparing assessment and diagnosis. Due to the open-ended nature of the diagnosis, interobserver agreement could not be measured. Instead, we used an expert panel of two additional otolaryngologists to compare the diagnoses of the two physicians for rate of concordance using the on-site physician’s diagnoses as the gold standard.

RESULTS

Patient Demographics

Twenty-one patients were enrolled and completed the pilot study (Table I). The mean age was 60 years, and 17 of 21 (81%) patients were female. Most patients (17 of 21, 81%) had a high school education or less. Only one patient (5%) completed college. Over half (12 of 21, 57%) of patients were retired; five of 21 (24%) reported active employment. New patients were seen in 20 of 21 encounters; the only established patient included presented with a new complaint.

Survey Results

For all 21 patient encounters included in this study, post-encounter surveys were completed by both patients and physicians (Figs. 4 and 5). Physician survey results showed 100% and 98% satisfaction with image and audio quality, respectively. Physicians agreed that the system was easy to use and information presented was overall satisfactory to make a diagnosis (100%). Anterior rhinoscopy was the least satisfactory exam using the current equipment (59%). The other portions of the exam were satisfactory in 88% of cases or higher. Overall, the physicians did not feel the office visit was significantly lengthened by use of the telemedicine system, and no technological failures were encountered.

Patient-centered survey results (TESQ) (Fig. 5) also showed a high degree of satisfaction following the encounter. Notably, 20 of 21 (95%) patients agreed they could adequately see and hear the remote physician and felt comfortable discussing their health-related complaint with that provider. Most (17 of 21, 81%) patients felt telemedicine was an acceptable medium with which to receive healthcare, whereas 20 of 21 (95%) agreed that care was more accessible using this technology. Only three of 21 (14%) patients felt the encounter was significantly lengthened. After the visit, 18 of 21 (86%)

<table>
<thead>
<tr>
<th>Patient TeleENT Satisfaction Questionnaire (TESQ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer the following questions:</td>
</tr>
<tr>
<td>1. I could see the doctor clearly during the telemedicine visit.</td>
</tr>
<tr>
<td>2. I had no trouble hearing the doctor when he/she spoke to me.</td>
</tr>
<tr>
<td>3. The doctor seemed to understand my problem.</td>
</tr>
<tr>
<td>4. I was comfortable with and understood what the doctor told me about my complaint.</td>
</tr>
<tr>
<td>5. A telemedicine visit makes receiving care more accessible (i.e. I don’t have to drive as far or an get an appointment more easily).</td>
</tr>
<tr>
<td>6. Telemedicine saves me time travelling to a hospital or specialty clinic.</td>
</tr>
<tr>
<td>7. I find telemedicine an acceptable way to receive health-care services.</td>
</tr>
<tr>
<td>8. I would prefer a face-to-face visit with the specialist rather than a telemedicine consultation.</td>
</tr>
<tr>
<td>9. This telemedicine visit was as good as a face-to-face encounter.</td>
</tr>
<tr>
<td>10. Overall, I am satisfied with the quality of service being provided via telemedicine.</td>
</tr>
<tr>
<td>11. I would use telemedicine services again.</td>
</tr>
</tbody>
</table>

Answer the following questions yes or no.

12. If the local ENT doctor was not available, would you have traveled to OSU Medical Center to see an ENT specialist?
13. Would you be comfortable going to an office for a telemedicine encounter?
14. Do you believe the encounter took longer due to the use of telemedicine?

---

**TABLE I.**

<table>
<thead>
<tr>
<th>Patient and Telemedicine Encounter Characteristics</th>
<th>Number (%) or Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>59.8 (23.5)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4 (19%)</td>
</tr>
<tr>
<td>Female</td>
<td>17 (81%)</td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
</tr>
<tr>
<td>Some high school</td>
<td>7 (33%)</td>
</tr>
<tr>
<td>High school</td>
<td>7 (33%)</td>
</tr>
<tr>
<td>Some college</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>College</td>
<td>1 (5%)</td>
</tr>
<tr>
<td>Trade/technical/vocational</td>
<td>3 (14%)</td>
</tr>
<tr>
<td>Chief Complaint</td>
<td></td>
</tr>
<tr>
<td>Otologic</td>
<td>13 (62%)</td>
</tr>
<tr>
<td>Sinonasal</td>
<td>1 (4.8%)</td>
</tr>
<tr>
<td>Pharyngeal/tonsil</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>Voice</td>
<td>3 (14%)</td>
</tr>
<tr>
<td>Neck-related</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>Type of Visit</td>
<td></td>
</tr>
<tr>
<td>New patient</td>
<td>20 (95%)</td>
</tr>
<tr>
<td>Follow-up</td>
<td>1 (5%)</td>
</tr>
<tr>
<td>Postoperative</td>
<td>0 (0.0%)</td>
</tr>
</tbody>
</table>

Demographic and clinical information regarding patients seen during the piloted synchronous telemedicine clinic (N = 21).

SD = standard deviation.
patients stated they were overall satisfied by the telemedicine encounter, and 19 of 21 (90%) stated they would use this technology again. Interestingly, only 13 of 21 (62%) patients indicated they would travel to see an otolaryngologist if one was not available in their community. This finding suggests that more than one-third of patients may not have pursued otolaryngology care at all if required to travel to a distant location for evaluation.

**Diagnostic Concordance**

Our expert otolaryngology panel assessed diagnostic concordance using the telemedicine system. Overall, concordance by the on-site and remote physician was seen in 95% of cases. Considering the on-site physician as the gold standard, the remote physician was able to provide a concordant diagnosis in 20 of 21 encounters using only the telemedicine system. The single incorrect diagnosis was determined to be due to lack of diagnostic specificity by the remote physician when compared to the on-site physician regarding a patient diagnosed with sensorineural hearing loss and dizziness versus hearing loss and lightheadedness. Diagnoses of patients from the pilot study are shown in Table II.

**DISCUSSION**

Population growth and physician shortages, coupled with improved and more affordable technology, have led to increased interest and application of telemedicine...
of care that patients would receive if they had travelled
endoscopy. Our goal here was to deliver the same quality
cian extender who would be well-trained in otoscopy and
telemedicine otolaryngology clinic using an on-site physi-
study was done in anticipation of eventually opening a
ing a high standard of care for our patients. This pilot
overall patient and provider satisfaction while maintain-
areas where only 55.3% of the population reside. This
maintaining high demands on the current workforce.
Furthermore, 61.8% of practicing otolaryngologists are
programs. This is especially true in otolaryngology, where
we have seen meager increases in residency positions
keeping high demands on the current workforce.14,15
Furthermore, 61.8% of practicing otolaryngologists are
located in metropolitan (population greater than 1 million)
areas where only 55.3% of the population reside. This
leaves a staggering 2,064 counties nationwide lacking a
single otolaryngologist.15 Needless to say, expanding the
reach of otolaryngologic care is both warranted and
essential.

It previously has been shown that otolaryngology
telemedicine examinations compare well to in-person
examinations. Of course, this can be affected by the
skills of examiners and the quality of transmitted
information; however, these factors can be controlled using
an organized system that applies current technology by
properly trained healthcare providers.7,16,17 As such, for
this pilot study we used an otolaryngologist to perform
all examinations because our goal was to assess the fea-
sibility and fidelity of clinical setup, equipment, and
overall patient and provider satisfaction while maintain-
ing a high standard of care for our patients. This pilot
study was done in anticipation of eventually opening a
telemedicine otolaryngology clinic using an on-site physi-
cian extender who would be well-trained in otoscopy and
endoscopy. Our goal here was to deliver the same quality
care that patients would receive if they had travelled
to our tertiary care center, and to evaluate whether the
telemedicine system would impose barriers due to tech-
ology or other extraneous factors that are not typically
associated with a standard office encounter. In doing so,
we were able to validate our equipment and our tele-
medicine system in a rigorous fashion.

A successful, sustainable telemedicine clinic
requires focus and attention to three key principles: con-
gruency, fidelity, and reliability.17 Congruency is defined
as the extent to which procedures done via telemedicine
mimic the real-life counterpart. In our pilot study, this
was achieved using high-definition, streamed images.
Fidelity states the degree of similarity of transmitted
information between telemedicine and in-person ses-
sions, and reliability is the consistency with which infor-
mation is provided. Indeed, our pilot clinic demonstrated
a congruent diagnosis between physicians in 95% of
cases. Additionally, all parties agreed, when surveyed
post-encounter, that imaging and audio quality was satis-
factory for clinical assessment and diagnosis. The low-
est satisfaction scores were reported for anterior
rhinoscopy (59%), and this was due to poor lighting on
streamed images.

Overall, this pilot clinic was also shown to be effi-
cient, effective, and satisfactory based on post-encounter
surveys and a patient-centered questionnaire (TESQ).
A majority of otolaryngology patients from smaller commu-
nities dislike or lack the means to travel to larger urban
areas and navigate an academic campus, especially for
routine follow-up visits or straightforward new patient
visits. A telemedicine service could improve efficiency of
such visits, and there are significant cost benefits for
both the patient system and the hospital system, which
have been shown in the past and are a topic that we pre-
sent in a separate report.18 This approach also could
expedite identification of patients with more complicated
problems, who could then be referred to the academic
medical center, with any imaging, biopsy, preoperative
clearance, or other consults needed scheduled and
obtained in one visit.

Tertiary referral centers play an important role in
healthcare, but distance and lack of familiarity can be
barriers to patients seeking care at these centers. As
reported, nearly 40% of patients in this pilot clinic
stated that they would not have travelled for otolaryn-
gology care. Consequently, limited access may contribute
to significant delays or lack of diagnosis and treatment.
This model seeks to maintain specialty care at the com-
community level until a subspecialty referral is indicated or
required. The patients not requiring referral can con-
tinue to be followed by the on-site provider, with interval
remote otolaryngology consultations as needed.

The ability to offer high-quality and efficient care
ideally will expand access to care, improve time to diag-
nosis, maintain high patient satisfaction, and decom-
press clinical wait times. We also strive to create
additional community and academic medical center rela-
tionships though this combined technology. Furthermore,
with the use of validated equipment and telemedicine
technology that allows for high diagnostic congruency,
we will continue to collect prospective data on cost,

<table>
<thead>
<tr>
<th>Patient Number</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dysphonia</td>
</tr>
<tr>
<td>2</td>
<td>Vocal cord leukoplakia</td>
</tr>
<tr>
<td>3</td>
<td>Stapedial myoclonus</td>
</tr>
<tr>
<td>4</td>
<td>Acute otitis externa</td>
</tr>
<tr>
<td>5</td>
<td>Snoring, recurrent tonsillitis</td>
</tr>
<tr>
<td>6</td>
<td>Sensorineural hearing loss, cerumen impaction</td>
</tr>
<tr>
<td>7</td>
<td>Sensorineural hearing loss, cerumen impaction</td>
</tr>
<tr>
<td>8</td>
<td>Reinke’s edema, tobacco abuse</td>
</tr>
<tr>
<td>9</td>
<td>Thyroid nodule</td>
</tr>
<tr>
<td>10</td>
<td>Epistaxis, septal deviation</td>
</tr>
<tr>
<td>11</td>
<td>Cerumen impaction, vertigo</td>
</tr>
<tr>
<td>12</td>
<td>Dizziness, hearing loss</td>
</tr>
<tr>
<td>13</td>
<td>Right tympanic membrane perforation, hearing loss</td>
</tr>
<tr>
<td>14</td>
<td>Neck abscess</td>
</tr>
<tr>
<td>15</td>
<td>Benign positional paroxysmal vertigo, hearing loss</td>
</tr>
<tr>
<td>16</td>
<td>Buccal lesion</td>
</tr>
<tr>
<td>17</td>
<td>Asymmetric sensorineural hearing loss, dizziness, possible Meniere’s</td>
</tr>
<tr>
<td>18</td>
<td>Temporomandibular joint pain, otalgia, hearing loss</td>
</tr>
<tr>
<td>19</td>
<td>Tinnitus, hearing loss</td>
</tr>
<tr>
<td>20</td>
<td>Otitis media, tympanostomy tube check</td>
</tr>
<tr>
<td>21</td>
<td>Sensorineural hearing loss, acute otitis externa</td>
</tr>
</tbody>
</table>
efficiency, and outcomes as our telemedicine pilot clinic progresses to incorporate a physician extender into a community-based otolaryngology clinic in the future. Demonstration of the success of this approach will be paramount in securing the role of telemedicine in otolaryngology.

There are several weaknesses to this study. First, we were unable to statistically analyze the physician diagnoses due to the open-ended nature of the recording process. As such, when assessing agreement between the referring and consulting physician, a kappa coefficient could not be calculated, which is the typical way of assessing interrater agreement. Also, we incorporated only one on-site and remote physician to pilot this system. Including more providers, and ultimately including a physician extender as the on-site clinician, will help to confirm and solidify the congruency, fidelity, and reliability of this telemedicine system. Finally, the anterior rhinoscopy exam was limited by lighting on streamed images, which will need to be addressed moving forward to improve anterior rhinoscopy exam without overuse of endoscopy in routine situations.

CONCLUSION
A synchronous or real-time pilot otolaryngology telemedicine clinic was found to be equivalent to a standard otolaryngology clinic in terms of diagnostic concordance and patient and provider satisfaction. This study provides further evidence that a real-time telemedicine model may be a viable option to expand specialty care to remote or underserved areas. The long-term goal of this project ultimately is to establish a general otolaryngology clinic run by a physician extender, with remote tele-consultation provided by a board-certified otolaryngologist. As this clinic model develops, further data will be needed regarding feasibility, long-term outcomes, patient and clinician satisfaction, and overall economic impact.

Acknowledgment
All authors contributed significantly to the clinical and academic work regarding completion of this report and had access to all necessary data and information regarding this article. The corresponding author takes full responsibility for the accuracy of this work. We would like to thank Fayette County Memorial Hospital and the clinical staff for their support setting up and executing this telemedicine pilot clinic.

BIBLIOGRAPHY